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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/752,534 | 12/29/2000 | Manoj Khare | 42390P9878 | 1416 |

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EXAMINER

PATEL, HETUL B

| ART UNIT | PAPER NUMBER |
|----------|--------------|
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2186

DATE MAILED: 08/18/2004

14

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/752,534

Applicant(s)

KHARE ET AL.

Examiner

Hetul Patel

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 July 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 27-43 is/are pending in the application.
- 4a) Of the above claim(s) 2-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 27-43 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☒ Interview Summary (PTO-413)
Paper No(s)/Mail Date 14.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Specification

1. This action is responsive to communication filed on July 26, 2004. This amendment has been entered and carefully considered. Claim 1 is again presented for examination; claims 2-28 are cancelled and claims 27-43 are newly added.
2. Examiner has removed two lines (as shown in PTO-413B) from independent claims 1, 32 and 38 as suggested by the Attorney, Libby Hope. The amended claims showing this change is requested in the next response to this Office Action.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.
3. Claims 1, 27-29, 31-35, 37-41 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson et al. (USPN: 6,598,123), hereinafter, Anderson, in view of Witt (USPN: 5,623,627).

As per claims 1 and 32, Anderson teaches a method and a machine-readable medium that is used in multi-processor system (1 in Fig. 1) comprising a snoop filter (5 in Fig. 1 and 20 in Fig. 2). Furthermore, Anderson teaches that

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the snoop filter is used to maintain the cache coherency state information for each cache line (e.g. see Col. 1, lines 14-33). However, Anderson does not teach that the method and the machine-readable medium having instructions, which when executed by a machine generates result, comprises steps of determining if the state of the line is an ambiguous state and resolving the ambiguous state by writing one of the contents and the modified contents to the requesting node if the contents have been modified. Witt, on the other hand, teaches that

- in response to a request from a requesting node of a plurality of caching nodes to access contents of a cache line, determining if a state of the cache line is an ambiguous state (e.g. see column 11, lines 4-5). As per definition of an ambiguous state given in the specification of this application, "an ambiguous state is a condition that identifies the last known state of the cache line at a member node that could have changed since last identified state". According to this definition, when the last known state of the member node is shared state and if the shared data is modified at some other shared node, then the member node turns into ambiguous state; and
- if the state is an ambiguous state, resolving the ambiguous state by determining if the contents have been modified, and writing one of the contents and the modified contents to the requesting node (e.g. see column 11, lines 5-9).

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Accordingly, It would have been obvious to one of ordinary skill in the art at the time of the current invention was made to modify the method and the machine-readable medium disclosed by Anderson, by adding two steps, determining and resolving the ambiguous state upon request to access the contents, as taught by Witt. In doing so, every modification made to the data on other/neighbor node will be broadcasted to other nodes and the main memory and therefore, data coherency is guaranteed and maintained throughout the system.

As per claim 38, Anderson teaches a shared memory multiprocessor system (1 in Fig. 1) comprising:

- a plurality of caching nodes (2 of Fig. 1), including a requesting node and a responding node; and
- a scalability port switch (10 in Fig. 1) having a snoop filter (5 in Fig. 1), the snoop filter having a plurality of caches (22 in Fig. 2) to maintain information about the state of each cache line at the plurality of caching nodes (e.g. see Col. 3, lines 23-32).

However, Anderson does not teach that the scalability port switch capable of steps of determining if the state of the line is an ambiguous state and resolving the ambiguous state by writing one of the contents and the modified contents to the requesting node if the contents have been modified. Witt, on the other hand, teaches that

- in response to a request from the requesting node to access contents of cache line, determining if a state of the cache line is ambiguous

state (e.g. see column 11, lines 4-5). As per definition of an ambiguous state given in the specification of this application, "an ambiguous state is a condition that identifies the last known state of the cache line at a member node that could have changed since last identified state". According to this definition, when the last known state of the member node is shared state and if the shared data is modified at some other shared node, then the member node turns into ambiguous state; and

- if the state is an ambiguous state, resolving the ambiguous state by determining if the contents have been modified, and writing one of the contents and the modified contents to the requesting node (e.g. see column 11, lines 5-9).

Accordingly, It would have been obvious to one of ordinary skill in the art at the time of the current invention was made to modify the shared memory multiprocessor system taught by Anderson, by adding two steps, determining and resolving the ambiguous state upon request to access the contents, as taught by Witt. In doing so, every modification made to the data on other/neighbor node will be broadcasted to other nodes and the main memory and therefore, data coherency is guaranteed and maintained throughout the system.

As per claims 27, 33 and 39, the combination of Anderson and Witt teaches the claimed invention as described above and furthermore, Anderson teaches the method, system and memory-readable medium wherein the snoop filter (20

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in Fig. 2) additionally maintains a presence vector (33 in Fig. 3) having one bit for each of the plurality of caching nodes, the presence vector to indicate that a given caching node of the plurality of caching nodes has a copy of the contents (e.g. see Col. 2, line 59 – Col. 3, line 3; Col. 3, lines 45-47 and Figs. 2-3).

As per claims 28, 34 and 40, the combination of Anderson and Witt teaches the claimed invention as described above and furthermore, Anderson teaches the method, system and memory-readable medium wherein the determining that a responding node of the plurality of caching nodes has exclusive ownership (based on exclusive bit 32 in Fig. 3) of the contents comprises accessing the snoop filter (20 in Fig. 2) to check the presence vector (33 in Fig. 3) and the state of the cache line (e.g. see Col. 3, lines 43-51).

As per claims 29, 35 and 41, the combination of Anderson and Witt teaches the claimed invention as described above. The steps of maintaining the current status of the cache line at the responding node, and the determining whether the contents of the cache line is modified or not by snooping the responding node, occurs in the multiprocessor system with MESI protocol, which is well-known and notorious old in the art. By performing these steps, data coherency is guaranteed and maintained throughout the system. The Examiner herein taking Official Notice on this subject matter.

As per claims 31, 37 and 43, the combination of Anderson and Witt teaches the claimed invention as described above and furthermore, Anderson teaches the method, system and memory-readable medium wherein each of the plurality

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of caching nodes implements a Modified, Exclusive, Shared and Invalid (MESI) protocol (e.g. see Col. 3, lines 38-42).

4. Claims 30, 36 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson et al. (USPN: 6,598,123), hereinafter, Anderson, in view of Witt (USPN: 5,623,627) further in view of Weber (USPN: 6,631,448).

As per claims 30, 36 and 42, the combination of Anderson and Witt teaches the claimed invention as described above. However, both Anderson and Witt failed to teach that the contents of the cache line are permanently stored at a home node of the plurality of caching nodes, and if the contents have been modified, then the modified contents is written to the home node. Weber, on the other hand, teaches the "writeback" process, which was also very well known in the art at the time of the current invention was made. In the writeback process, the contents of the cache line are permanently stored at a home node (i.e. main memory) of the plurality of caching nodes, and if the contents have been modified, then the modified contents is written to the home node (e.g. see Col. 6, lines 35-40). Accordingly, It would have been obvious to one of ordinary skill in the art at the time of the current invention was made to modify the method, system and memory-readable medium taught by the combination of Anderson and Witt, so the contents of the cache line are permanently stored at a home node of the plurality of caching nodes, and if the contents have been modified, then the modified contents are written to the home node. In doing so, every modification made to the data on other/neighbor node will be broadcasted to

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other nodes and the main memory (the home node) and therefore, data coherency is guaranteed and maintained throughout the system.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hetul Patel whose telephone number is (703) 305-6219. The examiner can normally be reached on M-F 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt Kim can be reached on (703) 305-3821. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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